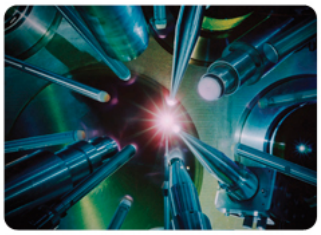
LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Aug. 19-23, 2013.

LaserFocusWorld IT'S SHOCKING



Lawrence Livermore researchers used the Omega laser system to compress iron up to 5.6 million atmospheres.

Using the OMEGA laser at the Laboratory for Laser Energetics (LLE) at the University of Rochester, researchers at Lawrence Livermore and LLE have compressed iron to 5.6 million atmospheres, which is greater than the pressure at the center of the Earth.

Iron is the most abundant element in Earth's core and the sixth most abundant element in the universe. As a key component of terrestrial planets and exoplanets, iron has been one of the most studied materials under extreme conditions. The extreme pressures provide insight into materials' behavior at extreme pressures similar to what occurs during planet formation.

The record pressure is achieved by dynamic multishock compression. Using a series of shocks (rather than a single shock) keeps the entropy low while compressing the material, which is key to keeping the temperature lower than the melting point and allowing the iron to remain solid. The result is iron with a close-packed structure.

To read more, go to *Laser Focus World*.

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YOUR UNIVERSE ONLINE

A MINERAL BY ANY OTHER NAME

Cosmochemist Ian Hutcheon holds a piece of the meteorite Allende, which contains some of the oldest objects in the solar system. A new mineral, hutcheonite, is named in honor of the researcher.

A recently discovered mineral appears to be clear but may have a tinge of light blue. No matter its color, you won't be able to make earrings from it.

For one, you can't see the material with the naked eye. Hutcheonite, recently named after Lawrence Livermore meteorite researcher Ian Hutcheon, can be seen only with high-powered scanning electron microscopes.

Hutcheonite was discovered in a refractory inclusion in the Allende meteorite by Sasha Krot (University of Hawaii) and Chi Ma (Caltech) and named in honor of Hutcheon, who has made numerous contributions to the study of meteorites and what they can tell us about the evolution of the early solar system.

Refractory inclusions within meteorites are the oldest objects in the solar system. Hutcheon has been studying these, specifically in the meteorite Allende, since his days as a postdoc at the University of Chicago in 1975.

To read more, go to *Red Orbit*.

fedscoop
BLASTS ON THE BRAIN

LLNL mechanical engineer Mike King (left) and physicist Willy Moss watch a compression test of a helmet pad. The pair has found a simple way to potentially reduce the severity of traumatic brain injury from blunt and ballistic impacts.

The effects of traumatic brain injury on a member of the armed forces can be debilitating.

A few years back, researchers at Lawrence Livermore completed a one-year study funded by the Army and the Joint IED Defeat Organization to compare the effectiveness of various military and football helmet pads in mitigating the severity of impacts. Building off the study findings, a new mechanism was discovered that may contribute significantly to the detection from blast-induced traumatic brain injury.

Work is under way on sensors that can be integrated into helmets, vehicles or building design. The readout from these devices can detail the extent of the blast, and this would help medical staff better assess the injury.

To read more, go to *fedscoop*.

the Maitland Mercury

THE WEIGHT OF THE WORLD

The periodic table of today may be a bit different than earlier charts.

Some of the heaviest elements (also known as superheavy) have been officially named flerovium (Fv) for 114 and livermorium (Lv) for 116.

The short-lived elements -- the first to join the table since 2009 when element 112, named copernicium after astronomer Nicolaus Copernicus, was added -- were originally detected in 2004 and 2006. But they have taken until now to be verified.

The research was conducted in heavy-ion particle accelerators at Russia's Joint Institute of Nuclear Research in Dubna, in conjunction with Lawrence Livermore.

To read more, go to *The Maitland Mercury*.

SCIENCE NOTES 2013 CHECKING THE PULSE

Using accelerator mass spectrometry, physicist Bruce Buchholz has found a way to assist cold cases.

Lawrence Livermore physicist Bruce Buchholz has analyzed a portion of a tooth, extracted from a partial skull found in Canada four decades ago, to help identify a missing child using the Laboratory's Center for Accelerator Mass Spectrometry (CAMS).

The child's skull was found in 1968, but the case of the missing child reopened a few years ago.

CAMS measures the precise weights of atoms. It's now a forensic tool, not just a research instrument; it can reveal when the tooth's owner was born. The clue lies inside the tooth, in an imprint made by atomic bombs.

Above-ground atomic testing in the 1950s and 1960s doubled the amount of radioactive carbon in the air (called the bomb pulse) and left an indelible mark in our bodies. That carbon has decreased ever since, and scientists can track it. One residue of that pulse lies in teeth. Enamel doesn't regenerate once it forms, so the radioactive carbon used to make it is locked in for life, or longer. By measuring this carbon in a tooth, Buchholz can estimate when it grew to within 1.5 years.

In the Canadian case, Buchholz and colleagues estimated the missing boy was born between 1959 and 1961. From there, forensic scientists were able to identify the child.

To read more, go to *Science Notes*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail